

FIG. 1

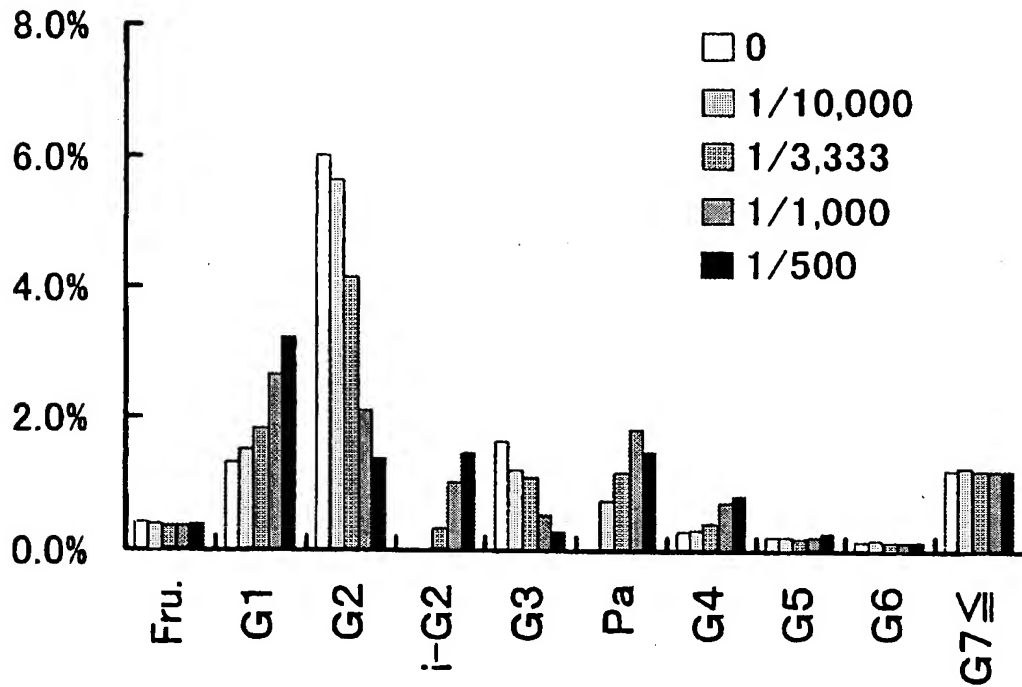
**Effect of α -Glucosidase dosage on sugar composition of wort**

FIG. 2

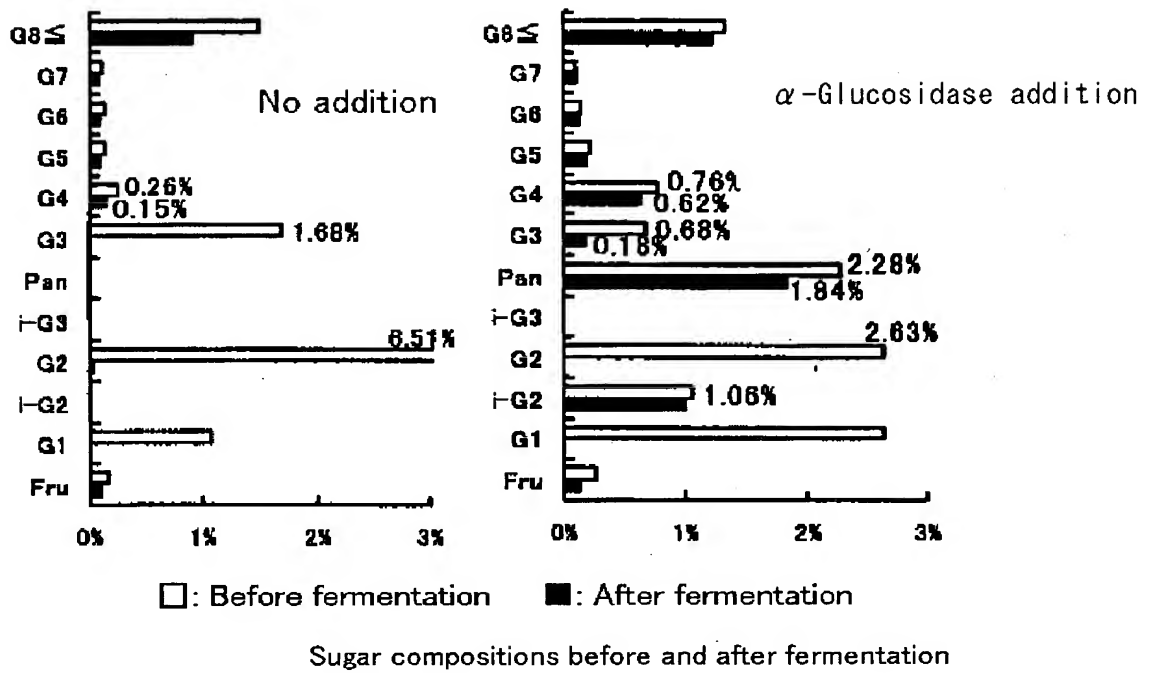


FIG. 3

Analysis of beer components (1)

	α -GLU addition	No addition
Alcohol (%)	4.41	5.95
Apparent extract (%)	4.84	1.76
Real extract (%)	6.42	3.89
Original extract of wort (%)	13.0	12.9
Apparent degree of fermentation (%)	62.8	86.4
Real degree of fermentation (%)	58.7	76.0

Analysis of beer components (2)

	α -GLU addition	No addition
Color (EBC)	11.9	10.8
pH	4.78	4.63
Acidity (mL)	2.29	2.29
Protein (%)	0.82	0.74
Amino acid (%)	0.30	0.26
Carbon dioxide (g/L)	4.68	4.65
Bitterness unit (BU)	24.0	25.4

Analysis of beer components (3)

	α -GLU addition	No addition
Phosphoric acid	976	850
Citric acid	288	295
Pyruvic acid	trace	46.7
Malic acid	153	146
Succinic acid	87.3	86.1
Lactic acid	79.2	89.8
Acetic acid	86.3	105
Pyroglutamic acid	273	244

(Unit: ppm)

Analysis of beer components (4)

	α -GLU addition	No addition
Ethyl acetate	28.7	35.2
n-Propanol	6.72	11.5
i-Butanol	14.0	14.0
Isoamyl acetate	1.19	1.32
i-Amyl alcohol	41.1	56.9
Ethyl caproate	0.18	0.31

(Unit: ppm)

FIG. 4

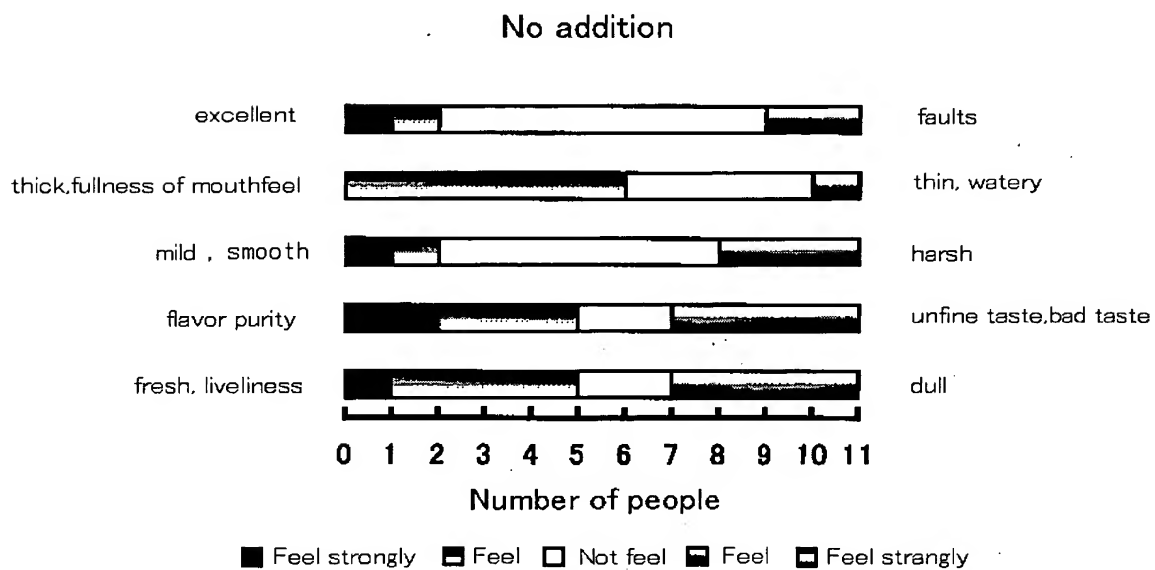
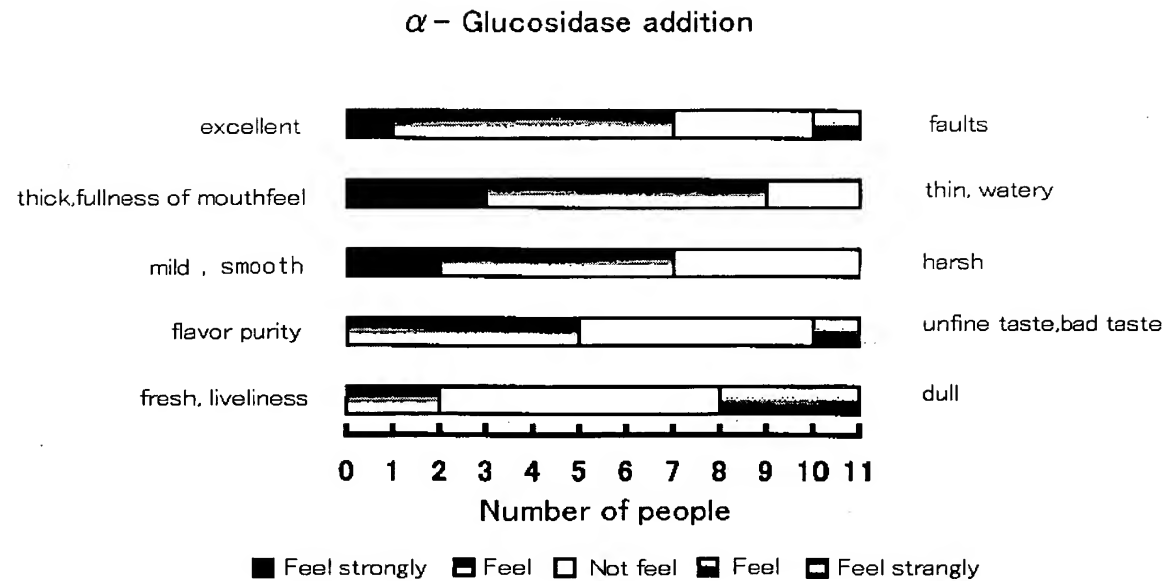
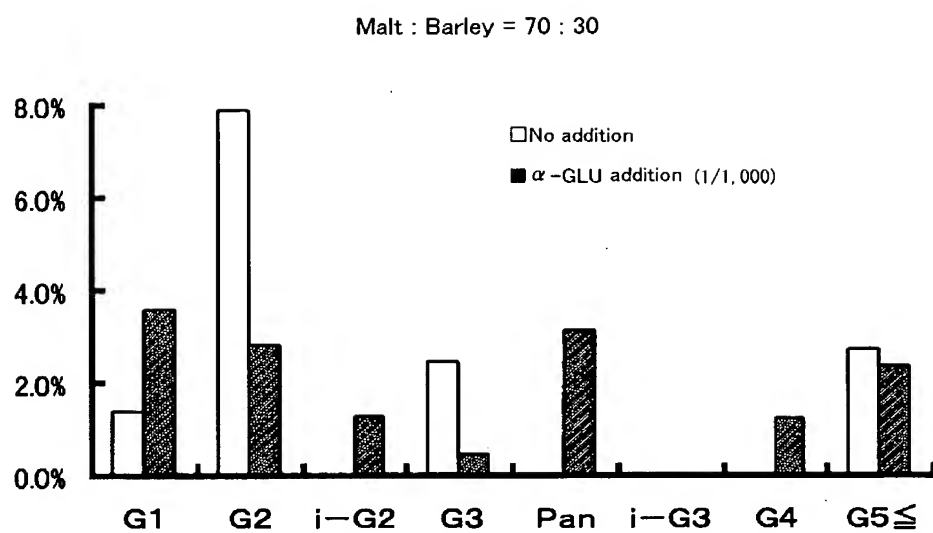
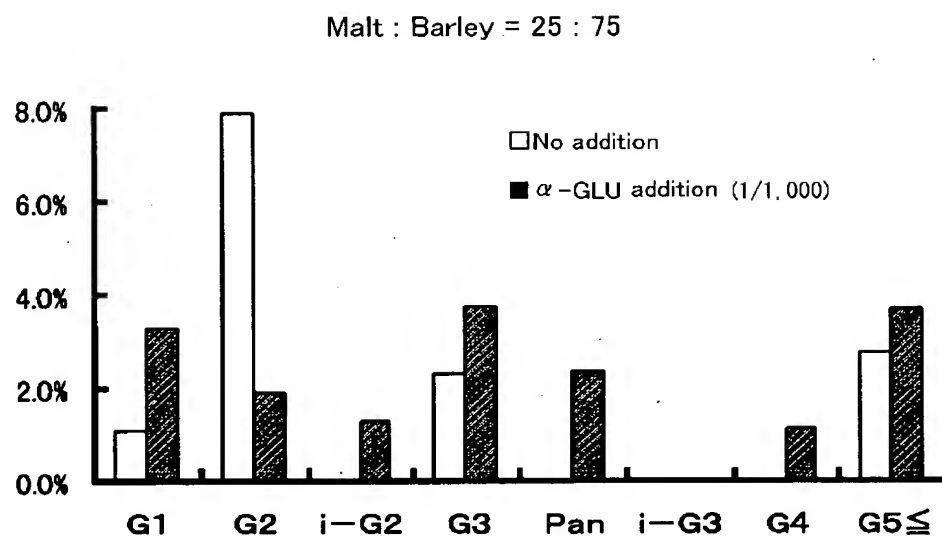


FIG. 5



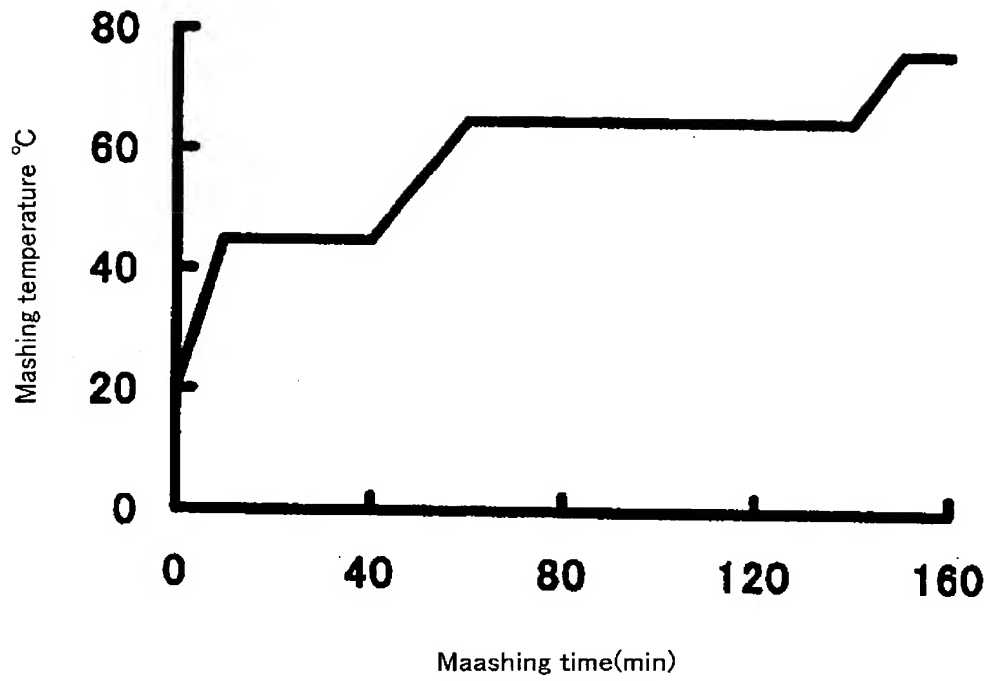
Effect of α -GLU addition on sugar composition of wort

FIG. 6



Effect of α -GLU addition on sugar composition of wort

FIG. 7



Temperature daigram during mashing

FIG. 8

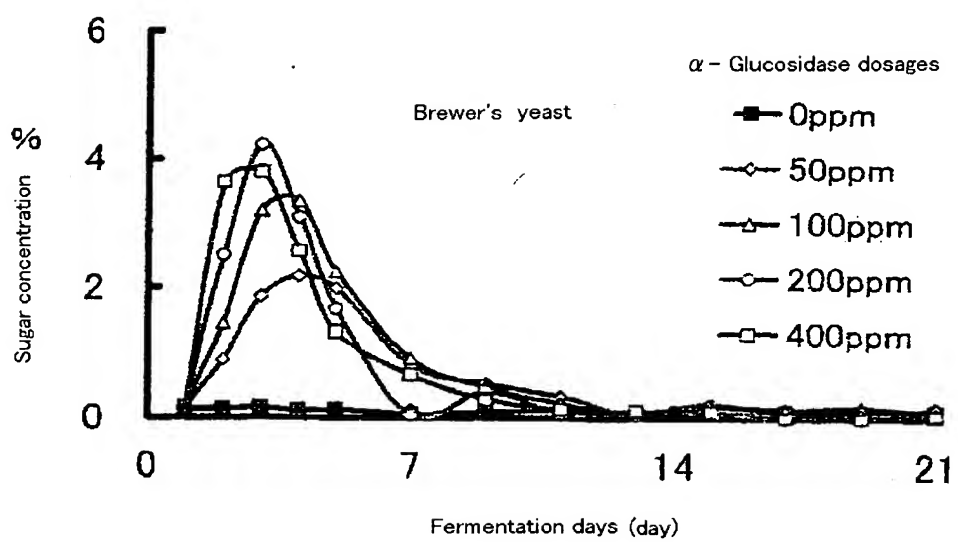


FIG. 9

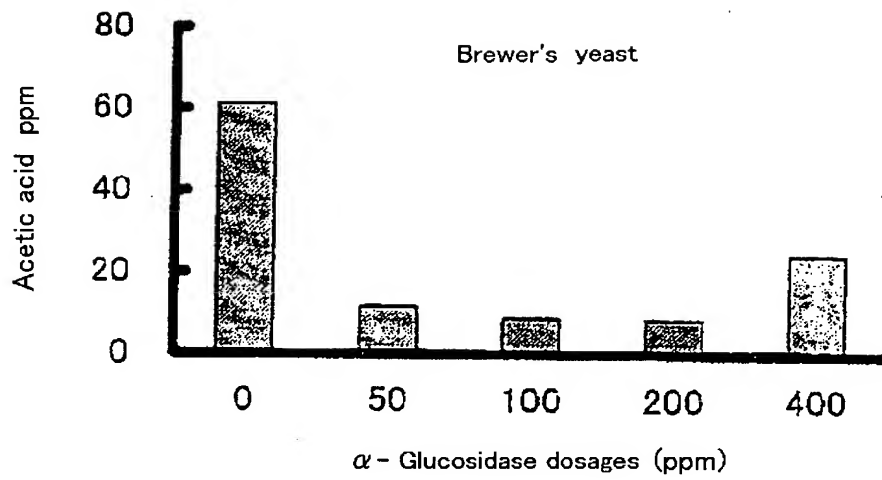


FIG. 10

	Brewer's yeast No addition	Sake yeast α -GLU addition	Sake yeast GA addition
Alcohol (v/v)	8.84	11.0	11.0
Real extract (w/w%)	7.02	4.09	3.90
Original extract (w/w%)	19.8	20.1	20.2
Glucose (%)	0.02	0.17	0.08
Maltose (%)	0.07	0.03	0.11
Malttriose (%)	0.97	0.33	0.24
Malttetrose (%)	0.17	—	0.02
Citric acid (ppm)	449	456	446
Malic acid (ppm)	214	259	265
Succinic acid (ppm)	134	285	255
Lactic acid (ppm)	135	187	168
Acetic acid (ppm)	140	139	288
Ethyl acetate (ppm)	84.8	93.5	112
1-Propanol (ppm)	22.2	23.8	24.6
Isoamyl acetate (ppm)	4.37	7.84	7.35
Isoamyl alcohol (ppm)	76.5	58.0	61.0
Ethyl caproate (ppm)	0.34	1.85	1.62
Amino acid (ppm)	3480	3250	3410

 α -GLU : α -Glucosidase

GA : Glucoamylase

FIG. 11

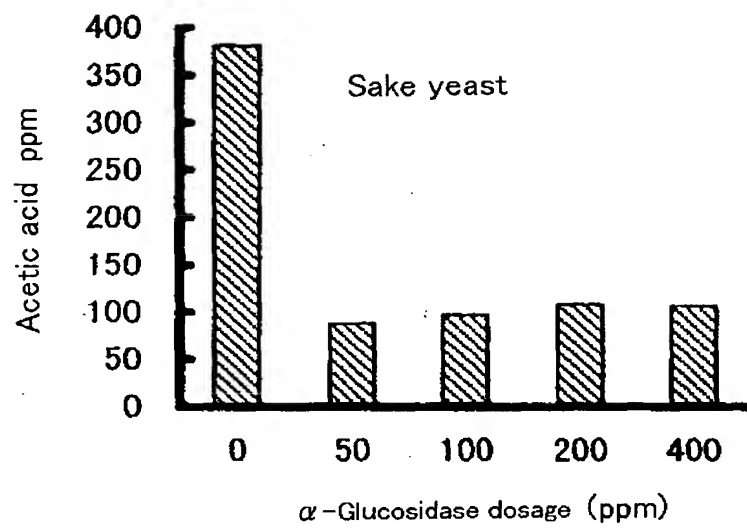


FIG. 12

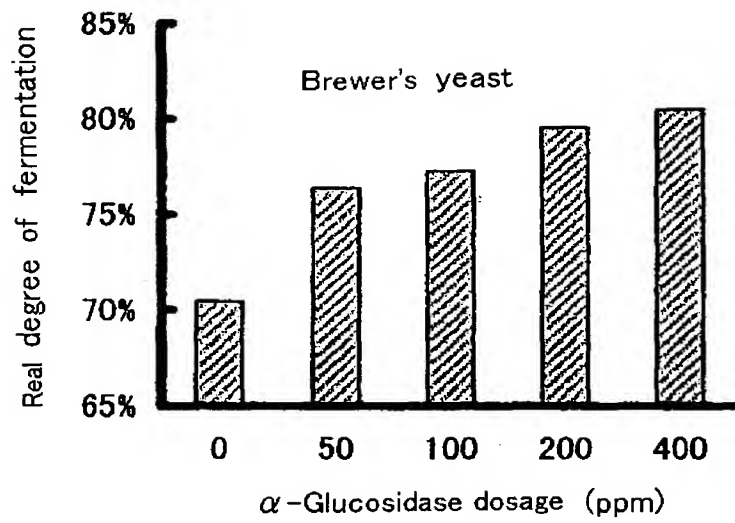


FIG. 13

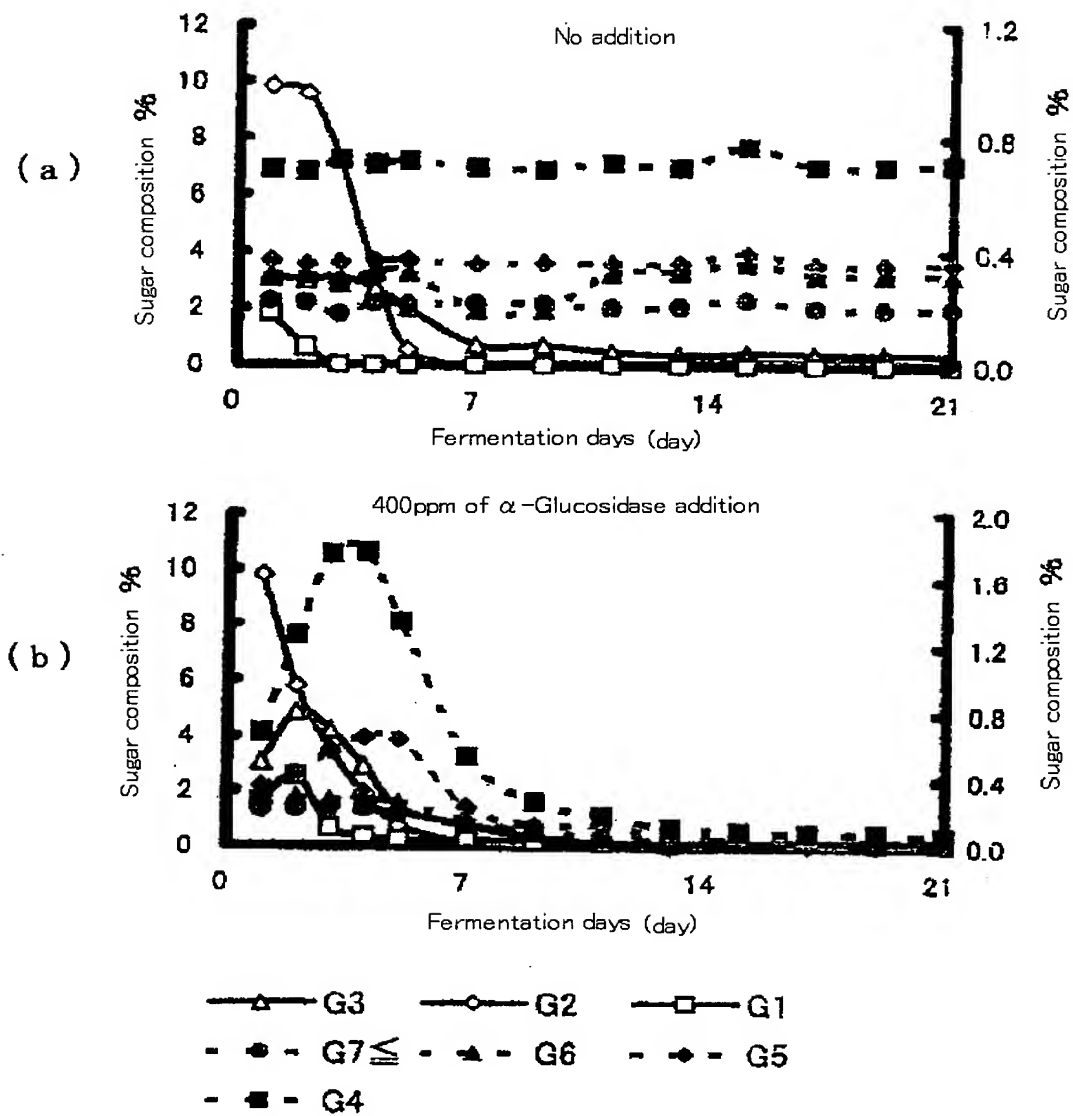


FIG. 14

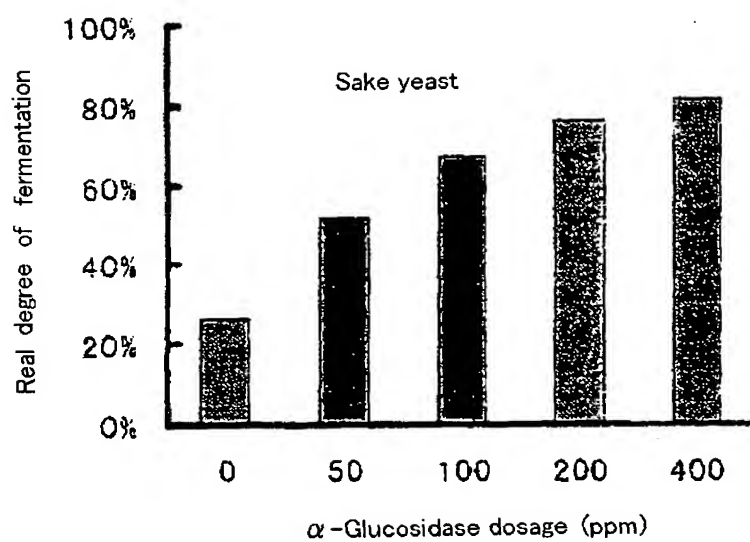


FIG. 15

